Q Fever

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To identify the source of infection (e.g., an outbreak at a rendering plant) and prevent further transmission from that source to others.
2. To educate potentially exposed persons about signs and symptoms of disease, thereby facilitating early diagnosis.
3. To raise the index of suspicion of a possible bioterrorism event if no natural exposure source is identified.

B. Legal Reporting Requirements

1. Health care providers: notifiable to local health jurisdiction within 3 work days.
2. Hospitals: notifiable to local health jurisdiction within 3 work days.
3. Laboratories: no requirements for reporting.
4. Veterinarian: immediately notifiable to Washington State Department of Agriculture or to the local health jurisdiction.
5. Local health jurisdictions: notifiable to DOH Communicable Disease Epidemiology Section (CDES) within 7 days of case investigation completion or summary information required within 21 days.

C. Local Health Jurisdiction Investigation Responsibilities

1. **If bioterrorism is suspected, immediately report the case to DOH: 1-877-539-4344.**
2. Facilitate the transport of specimens to DOH Public Health Laboratories (PHL) for confirmatory testing.
3. Identify potentially exposed persons and make appropriate recommendations.
4. Report all *confirmed* and *probable* acute and chronic cases to CDES (see definitions below). Complete the Q fever report form (http://www.doh.wa.gov/notify/guidelines/pdf/Qfever.pdf) and enter the data in the Public Health Issues Management System (PHIMS).

2. THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Q fever is caused by *Coxiella burnetii*, a gram negative bacterium with two antigenic phases. The organism is highly resistant to heat and many disinfectants and can survive under harsh environmental conditions. *C. burnetii* can reach high concentrations in animal tissues, particularly placentas, and can be spread by wind and stirred up dust. A few organisms can cause infection.

B. Description of Illness

Infections with *Coxiella burnetii* range from asymptomatic to severe in humans. Acute Q fever is characterized by fevers, chills, severe headache, malaise, and severe sweats. Severe disease can include acute hepatitis, atypical pneumonia, and meningoencephalitis. Pregnant women are at risk for fetal death and abortion. Clinical laboratory findings commonly include elevated liver enzyme levels. Only 1–2% of people with acute Q fever die of the disease.

Chronic Q fever occurs months to years after acute infection and manifests primarily as endocarditis involving abnormal cardiac valves. Q fever endocarditis often has a course extending over years, requiring protracted antibiotics and valve replacement. Immunocompromised individuals are particularly susceptible. Rare complications include chronic hepatitis alone or with endocarditis, osteomyelitis, osteoarthritis, or pneumonitis. As many as 65% of persons with chronic Q fever may die of the disease.

C. Q fever in Washington State

DOH receives 0 to 2 reports of Q fever per year. Occasionally infections are acquired in Washington.

D. Reservoirs

The most common reservoirs include sheep, cattle, and goats. Cats, dogs, and some wild animals and birds can also be infected. Infected animals are usually asymptomatic, but shed the organism in urine, feces, milk and especially birth products. Placental tissues from such animals are massively infected.

E. Modes of Transmission

The disease is most commonly acquired by inhalation of aerosols containing *C. burnetii*. This can occur through inhalation of dust from premises contaminated by placental tissues, birth fluids and excreta of infected animals; in establishments processing infected animal products; and in necropsy rooms. Aerosols containing the organism can also be inhaled during direct contact with infected animals or placentas and other contaminated materials, such as wool, straw, fertilizer and laundry.

Less common modes of transmission include ingestion of contaminated raw milk, tick bites, receipt of contaminated blood or bone marrow, and handling of cultures in the laboratory. Human to human transmission is rare.

F. Incubation Period

The incubation period depends on the size of the infecting dose, but is usually 2–3 weeks.

G. Period of Communicability

Direct person-to-person transmission occurs rarely, if ever. However, fomites such as contaminated clothing may be a source of infection.

H. Treatment

Doxycycline is the treatment of choice for acute *C. burnetii* infection and should be started promptly; monitor for relapses requiring retreatment. Chronic infections may require extended treatment with multiple antibiotics and endocarditis may in addition

require surgery.

3. CASE DEFINITIONS

A. Acute Q Fever

1. Clinical Presentation

Acute fever usually accompanied by rigors, myalgia, malaise, and a severe retrobulbar headache. Fatigue, night-sweats, dyspnea, confusion, nausea, diarrhea, abdominal pain, vomiting, non-productive cough, and chest pain have also been reported. Severe disease can include acute hepatitis, atypical pneumonia with abnormal radiograph, and meningoencephalitis. Pregnant women are at risk for fetal death and abortion. Clinical laboratory findings may include elevated liver enzyme levels, leukocytosis, and thrombocytopenia. Asymptomatic infections may also occur.

2. Clinical Evidence

Acute fever and one or more of the following: rigors, severe retrobulbar headache, acute hepatitis, pneumonia, or elevated liver enzyme levels.

3. Laboratory Evidence

a. Laboratory confirmed:

- Serological evidence of a fourfold change in immunoglobulin G (IgG)-specific antibody titer to *C. burnetii* phase II antigen by indirect immunofluorescence assay (IFA) between paired serum samples (CDC suggests one taken during the first week of illness and a second 3–6 weeks later; antibody titers to phase I antigen may be elevated or rise as well), or
- Detection of *C. burnetii* DNA in a clinical specimen via amplification of a specific target by polymerase chain reaction (PCR) assay, or
- Demonstration of *C. burnetii* in a clinical specimen by immunohistochemical methods (IHC), or
- Isolation of *C. burnetii* from a clinical specimen by culture.

b. Laboratory supportive:

- Has a single supportive IFA IgG titer of ≥1:128 to phase II antigen (phase I titers may be elevated as well).
- Has serologic evidence of elevated IgG or IgM antibody reactive with *C. burnetii* antigen by enzyme-linked immunosorbent assay (ELISA), dot-ELISA, or latex agglutination.

Note: Serologic profiles of pregnant women infected with acute Q fever during gestation may progress frequently and rapidly to those characteristic of chronic infection.

Note: For acute testing, CDC uses in-house IFA IgG testing (cutoff of ≥1:128), preferring simultaneous testing of paired specimens, and does not use IgM results for routine diagnostic testing.

4. **Case Classification (2009)**

   a. **Confirmed acute Q fever**: A laboratory confirmed case that either meets clinical case criteria or is epidemiologically linked to a lab confirmed case.

   b. **Probable acute Q fever**: A clinically compatible case of acute illness (meets clinical evidence criteria for acute Q fever illness) that has laboratory supportive results for past or present acute disease (antibody to Phase II antigen) but is not laboratory confirmed.

B. Chronic Q Fever

1. **Clinical Presentation**

   Infection that persists for more than 6 months. Potentially fatal endocarditis may evolve months to years after acute infection, particularly in persons with underlying valvular disease. Infections of aneurysms and vascular prostheses have been reported. Immunocompromised individuals are particularly susceptible. Rare cases of chronic hepatitis without endocarditis, osteomyelitis, osteoarthritis, and pneumonitis have been described.

2. **Clinical Evidence**

   Newly recognized, culture-negative endocarditis, particularly in a patient with previous valvulopathy or compromised immune system, suspected infection of a vascular aneurysm or vascular prosthesis, or chronic hepatitis, osteomyelitis, osteoarthritis, or pneumonitis in the absence of other known etiology.

3. **Laboratory Evidence**

   a. Laboratory confirmed:

   - Serological evidence of IgG antibody to *C. burnetii* phase I antigen ≥ 1:800 by IFA (while phase II IgG titer will be elevated as well; the phase I titer is higher than the phase II titer), or
   - Detection of *C. burnetii* DNA in a clinical specimen via amplification of a specific target by PCR assay, or
   - Demonstration of *C. burnetii* antigen in a clinical specimen by IHC, or
   - Isolation of *C. burnetii* from a clinical specimen by culture.

   b. Laboratory supportive:

   - Has an antibody titer to *C. burnetii* phase I IgG antigen ≥1:128 and < 1:800 by IFA.

   Note: Samples from suspected chronic patients should be evaluated for IgG titers to both phase I and phase II antigens. Current commercially available ELISA tests (which test only for phase II) are not quantitative, cannot be used to evaluate changes in antibody titer, and hence are not useful for serological confirmation. IgM tests are not strongly supported for use in serodiagnosis of acute disease, as the response may not be specific for the agent (resulting in false positives) and the IgM response may

be persistent. Complement fixation (CF) tests and other older test methods are neither readily available nor commonly used.

Serologic test results must be interpreted with caution, because baseline antibodies acquired as a result of historical exposure to Q fever may exist, especially in rural and farming areas.

4. **Case Classification (2009)**

   a. **Confirmed chronic Q fever:** A clinically compatible case of chronic illness (meets clinical evidence criteria for chronic Q fever) that is laboratory confirmed for chronic infection.

   b. **Probable chronic Q fever:** A clinically compatible case of chronic illness (meets clinical evidence criteria for chronic Q fever) that has laboratory supportive results for past or present chronic infection (antibody to Phase I antigen).

C. Exposure

Exposure is usually via aerosol, is broadly interpreted, and may be unknown (especially for chronic infection), but often includes the presence of goats, sheep, or other livestock, especially during periods of parturition. Direct contact with animals is not required, and variable incubation periods may be dose dependent.

4. DIAGNOSIS AND LABORATORY SERVICES

A. Laboratory Diagnosis

Laboratory diagnosis is commonly made by demonstration of a rise in specific antibodies in acute and convalescent specimens; high antibody titers to phase I of the infective organism indicate chronic infection, such as endocarditis. High phase II antibody titers occur during acute infection. The diagnosis can also be made by isolation of *C. burnetii* from blood or by identification of the organism in sputum or tissue (e.g., liver biopsy or heart valve) by culture, immunohistochemical methods, or PCR. These latter tests are less convenient than serologic tests because infected tissues and blood cultures from Q fever patients require processing in a biosafety level 3 laboratory to avoid exposures in laboratory workers

Confirmatory laboratory testing should be performed by a reference laboratory such as the Washington State Public Health Laboratories.

B. Tests Available at the Washington State Public Health Laboratories (PHL)

PHL does not perform testing for Q fever but will forward specimens to the CDC. Contact Communicable Disease Epidemiology Section for approval prior to submitting specimens.

C. Specimen Collection

Clinical laboratories should call PHL prior to shipping specimens (206-418-5400) for shipping instructions. Serum should be submitted with a completed PHL microbiology form (http://www.doh.wa.gov/EHSPHL/PHL/Forms/Microbiology.pdf).

5. ROUTINE CASE INVESTIGATION

Since Q fever is an uncommon disease, call CDES to discuss the case investigation. Interview the case and others who may be able to provide pertinent information. (For evaluation of a possible bioterrorist event, see Section 7 – Managing Special Situations)

A. Evaluate the Diagnosis

Collect copies of laboratory results. **Confirmatory laboratory testing should be performed by a reference laboratory such as DOH Public Health Laboratories.** Facilitate submission of laboratory specimens to PHL for confirmation. Proceed with investigation after preliminary or confirmatory laboratory results are available for sporadic cases. During an outbreak event or a potential bioterrorism situation, start investigation before laboratory results are available if needed.

B. Identify Potential Sources of Infection

Investigate possible exposures during the period 14–21 days before onset, including a history of:

1. Travel;
2. Contact with potentially infected animals or their tissues, particularly postpartum fluid or tissues;
3. Consumption of unpasteurized milk products;
4. Work with sheep, goats, cattle;
5. Work in a laboratory (especially animal necropsy); and
6. Possible exposure to dust or other aerosols associated with livestock.

C. Identify Potentially Exposed Persons

1. Identify and contact persons who participated with the case in any of the activities listed above. Inform them of their possible exposure and symptoms of Q fever in order to facilitate rapid diagnosis and therapy.
2. Identify laboratory workers who handled infected tissue or laboratory isolates and educate them about symptoms of illness to facilitate diagnosis.
3. See "Management of Exposed Persons" below for additional recommendations.

D. Environmental Evaluation

See environmental measures below to control further spread.

6. CONTROLLING FURTHER SPREAD

A. Infection Control Recommendations

Hospitalized patients should be cared for in accordance with standard precautions. Patients are not usually considered infectious to other persons, and special precautions are not required for routine care.

B. Case Management—No follow up needed

C. Contact Management

Determine if the case donated blood or tissue and notify the appropriate agency. Household and other close contact are not at increased risk since person-to-person transmission is rare.

D. Management of Other Exposed Persons

Persons exposed to the same source as the case should be educated regarding symptoms to facilitate early diagnosis. In general, specific management is not recommended for asymptomatic people who have been exposed (Red Book 2006 p. 551–2). For laboratory and other high-risk exposures, call CDES to discuss the need for chemoprophylaxis.

E. Environmental Measures

If the suspected source is in farm animals, contact CDES who will contact the Washington State Department of Agriculture.

7. MANAGING SPECIAL SITUATIONS

A. Bioterrorist Event

C. burnetii has been classified as a potential bioterrorism agent because of its very low infectious dose, its ability to survive in the environment, and the fact that it can potentially be disseminated by aerosol. One should suspect bioterrorist spread of Q fever if there is a cluster of patients with a nonspecific febrile illness and pulmonary symptoms in about one quarter of the cases. Chemoprophylaxis with tetracycline or doxycycline may be appropriate for people exposed in a bioterrorism event. ***If bioterrorism is suspected, call CDES immediately (24/7) at 1-877-539-4344.***

8. ROUTINE PREVENTION

A. Immunization Recommendations

There is currently no licensed vaccine against Q fever in the United States.

B. Prevention Recommendations (available at: http://www.cdc.gov/ncidod/dvrd/qfever/index.htm#prevention1)

1. Educate the public on sources of infection.
2. Appropriately dispose of placenta, birth products, fetal membranes, and aborted fetuses at facilities housing sheep and goats.
3. Restrict access to barns and laboratories used in housing potentially infected animals.
4. Use only pasteurized milk and milk products.
5. Use appropriate procedures for bagging, autoclaving, and washing of laboratory clothing.
6. Quarantine imported animals.
7. Ensure that holding facilities for sheep are located away from populated areas. Animals should be routinely tested for antibodies to *C. burnetii,* and measures should be implemented to prevent airflow to other occupied areas.
8. Counsel exposed persons at highest risk for developing chronic Q fever, especially persons with pre-existing cardiac valvular disease or individuals with vascular grafts.

ACKNOWLEDGEMENTS

This document is a revision of the Washington State Guidelines for Notifiable Condition Reporting and Surveillance published in 2002 which were originally based on the Control of Communicable Diseases Manual (CCDM), 17th Edition; James Chin, Ed. APHA 2000. We would like to acknowledge the Oregon Department of Human Services for developing the format and select content of this document.

UPDATES

December 2008:

Section 3: Minor wording changes were made to the case definition.
Section 4C: The link to the PHL microbiology form was updated.